

Large Single Crystal CVD Diamonds at Rapid Growth Rates

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The method of high growth rate single crystal CVD diamond [1] has opened new opportunities for the application of diamond. We report successful growth of large single crystal CVD diamond over 1 cm thick and 5 carat at growth rate of $\sim 100 \mu\text{m/h}$. Various single crystal diamonds were synthesized by MPCVD at 8-20% CH_4/H_2 , 0.2-3% N_2/CH_4 , 160-220 torr at various temperatures. All substrates were HPHT synthetic type Ib yellow diamonds with {100} faces on top and on the sides. Morphologies and colors of the as-grown CVD diamonds strongly depend on the deposition temperature. At temperatures over 1500°C , black layers begin to form. Below 900°C , black microcrystalline material is deposited. Smooth colorless CVD diamonds enlarged along three dimensions are observed at lower temperature deposition. To increase further the size of the crystals, including three dimensional enlargement, gem-quality CVD diamond are grown at the above conditions sequentially on the 6 {100} faces of the substrate. By this method, a one inch cube of single crystal diamond (~ 300 carat) is achievable.

1. C. S. Yan *et al.* (2002) *Proc. Natl. Acad. Sci.* **99**, 12523-12525.